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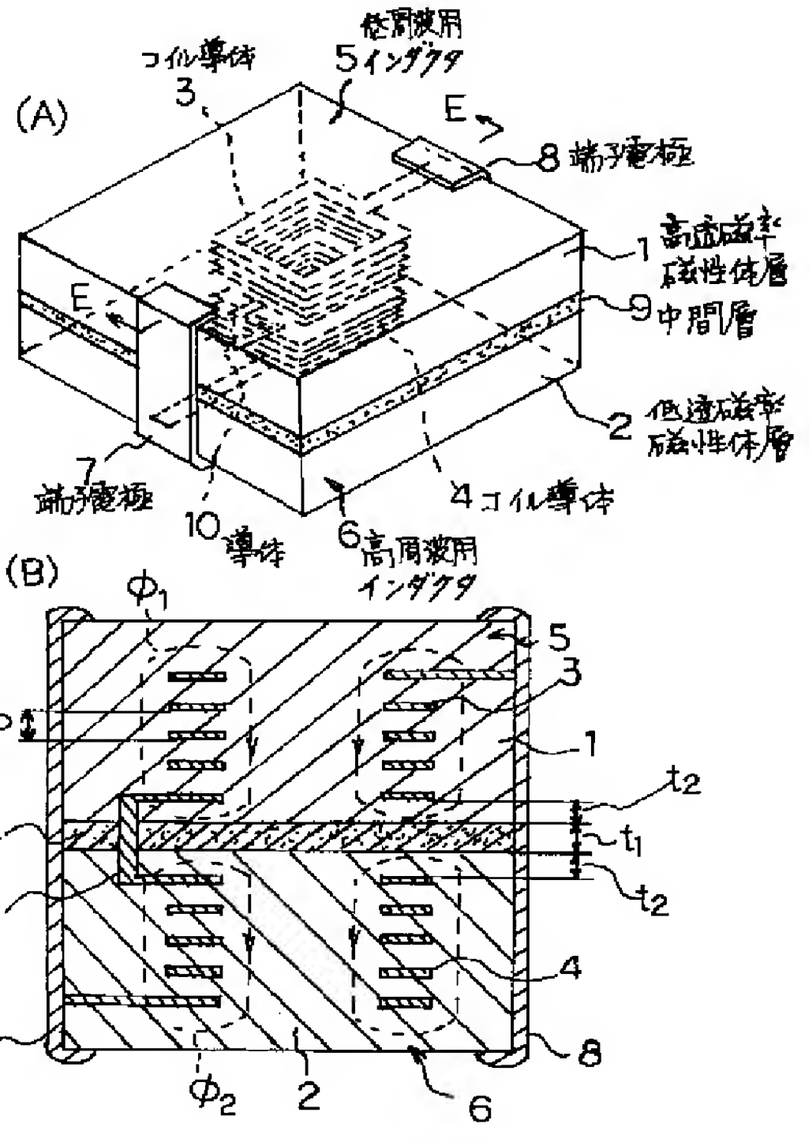
(54)【発明の名称】　積層ノイズ対策部品

(57)【要約】
【目的】異なる透磁率を有する複数の磁性体層にそれぞれコイル導体を内蔵して直列接続した積層ノイズ対策部品、または異なる誘電率を有する複数の誘電体層にそれぞれ内部電極を内蔵して並列接続した積層ノイズ対策部品において、それぞれ高周波用、低周波用構成要素（インダクタまたはコンデンサ）の特性を十分に生かし得るものを提供する。
【構成】透磁率が異なる磁性体層１、２の間に非磁性体でなる中間層９を一体に介在させた。また、中間層９に磁束の変化により短絡電流を流すショートリングを埋設した。また、誘電率が異なる誘電体層の間に前記各誘電体層より低誘電率の中間層を一体に介在させた。



【特許請求の範囲】
【請求項１】透磁率が異なる複数の磁性体層を積層し、各磁性体層にそれぞれコイル導体を内蔵すると共に、各磁性体層に内蔵したコイル導体を直列に接続してなる積層ノイズ対策部品において、
透磁率が異なる磁性体層の間に非磁性体でなる中間層を一体に介在させたことを特徴とする積層ノイズ対策部品。
【請求項２】請求項１において、前記中間層に磁束の変化により短絡電流を流すショートリングを埋設したことを特徴とする積層ノイズ対策部品。
【請求項３】誘電率が異なる複数の誘電体層を積層し、各誘電体にそれぞれ対向する内部電極を埋設してそれぞれ容量の異なるコンデンサを構成すると共に、各コンデンサを並列に接続してなる積層ノイズ対策部品において、
誘電率が異なる誘電体層の間に前記各誘電体層より低誘電率の中間層を一体に介在させたことを特徴とする積層ノイズ対策部品。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、異なる透磁率を有する複数の磁性体層にそれぞれコイル導体を内蔵してこれらのコイル導体を直列に接続した積層体、または誘電率が異なる複数の誘電体層を積層し、各誘電体にそれぞれ対向する内部電極を埋設してそれぞれ容量の異なるコンデンサを構成すると共に、各コンデンサを並列に接続してなる積層体により構成される積層ノイズ対策部品に関する。
【０００２】
【従来の技術】印刷法やシート法等の厚膜形成法を用い、磁性体とコイル導体とを積層してなるチップ状の積層体によって構成された積層ノイズ対策部品において、広い周波数帯域についてノイズ低減効果を得るため、特公平３－３０２８２号公報においては、図６（Ａ）の斜視図およびそのＧ－Ｇ断面図である（Ｂ）に示すように、相対的に高透磁率（低周波用）、低透磁率（高周波用）となる磁性体層１、２を積層し、各磁性体層１、２にそれぞれコイル導体３、４を内蔵してインダクタ５、６を構成すると共に、各磁性体層１、２に内蔵したコイル導体３、４を積層体内部において直列に接続してなるものが提案されている。これら一連に接続されるコイル導体３、４の両端は、チップ状に形成された積層体の側面に設けられた端子電極７、８に接続される。
【０００３】図６に示した積層ノイズ対策部品において、高透磁率層１と低透磁率層２とは、図７（Ａ）の上段に示すように、それぞれ透磁率＝１となる周波数f_1、f_2が異なり、低透磁率層２側のインダクタ６は、高い周波数帯域におけるノイズ除去の役目を果たすように期待される。
【０００４】
【発明が解決しようとする課題】しかし図６（Ｂ）の断面図に示すように、従来の積層ノイズ対策部品において、磁束φは高透磁率層１と低透磁率層２の双方にわたって順次通過することになり、起磁力V_mに対して高透磁率層１の磁気抵抗R_{m1}と低透磁率の磁気抵抗R_{m2}とが直列に接続された回路として把握され、さらに高透磁率層１の透磁率が１となる周波数f_1より低い周波数においては、積層ノイズ対策部品全体として図７（Ｃ）に示すように、高透磁率層１と低透磁率層２からなるコアが結合され、これにコイル導体３、４が巻かれたものと同等の作用をなすものとして認識でき、高透磁率層１の透磁率＝１となる周波数f_1より高く、かつ低透磁率層２の透磁率が１となる周波数f_2より低い周波数帯域においては、図７（Ｄ）に示すように、高透磁率層１が欠落した磁気回路として認識できる。このため、図７（Ａ）の下段に示すように、積層ノイズ対策部品全体としてのインピーダンスは、高透磁率層１によるインダクタ５によるインピーダンスよりやや高い程度となり、高周波用の低透磁率層２の特性を十分に生かすことができなかった。
【０００５】一方、異なる誘電率の２つの誘電体層を一体に積層し、各誘電体層にそれぞれ内部電極を設けて高周波、低周波用のコンデンサを構成し、各コンデンサを側面の端子電極で並列に接続したコンデンサ使用の積層ノイズ対策部品においては、高い周波数帯域において、高誘電率層を介してコンデンサどうしが結合するため、この場合にも高周波用のコンデンサの特性を十分に生かせないという問題点があった。
【０００６】本発明は、上記した問題点に鑑み、異なる透磁率を有する複数の磁性体層にそれぞれコイル導体を内蔵して直列接続した積層ノイズ対策部品、または異なる誘電率を有する複数の誘電体層にそれぞれ内部電極を内蔵して並列接続した積層ノイズ対策部品において、それぞれ高周波用、低周波用構成要素（インダクタまたはコンデンサ）の特性を十分に生かし得るものを提供することを目的とする。
【０００７】
【課題を解決するための手段】この目的を達成するため、本発明の積層ノイズ対策部品は、透磁率が異なる磁性体層の間に、非磁性体よりなる中間層を一体に介在させたことを特徴とする。また、前記中間層に磁束の変化により短絡電流を流して磁束の通過を減少させるショートリングを埋設したことを特徴とする。
【０００８】また、誘電率が異なる複数層の誘電体層によりコンデンサを構成するものにおいては、誘電率が異なる誘電体層の間に前記各誘電体層より低誘電率の中間層を一体に介在させたことを特徴とする。
【０００９】
【作用】本発明において、透磁率が異なる磁性体層の間

に非磁性体からなる中間層を一体に介在させたものにおいては、各磁性体層におけるインダクタの周波数特性がそれぞれ独立し、全体として個々の特性を加えた特性が得られ、従来より高い周波数帯域に至る広い周波数帯域におけるノイズ除去が可能となる。中間層にショートリングを設けたものにおいては、中間層における磁束の通過がさらに良好に防止される。誘電率が異なる複数層の誘電体層によりコンデンサを構成するものにおいては、誘電率が異なる誘電体層の間に前記各誘電体層より低誘電率の中間層を一体に介在させたことにより、異なる誘電率層間の結合が防止され、それぞれのコンデンサの特性を加えた合成特性が得られる。

【００１０】

【実施例】図１（Ａ）は本発明による積層ノイズ対策部品の一実施例を示す斜視図、（Ｂ）は（Ａ）のＥ－Ｅ断面図である。１、２はそれぞれ相対的に高透磁率、低透磁率の磁性体層であり、３、４は各磁性体層１、２に内蔵されたコイル導体であり、これらによりそれぞれ低周波用インダクタ５と高周波用のインダクタ６を構成する。９は磁性体層１、２間に一体に設けた中間層であり、該中間層９は非磁性体からなる。１０は各コイル導体３、４を積層体の内部において接続する導体である。７、８は一連に接続されたコイル導体３、４の両端に接続されるように、積層体の側面に設けられた端子電極である。

【００１１】該インダクタ５や中間層９からなる積層体は、印刷法あるいはシート法による積層、乾燥工程後、各チップ毎に切断して焼成するか、あるいは焼成後に切断することにより製造され、その後、その積層体の側面に端子電極７、８を焼き付けやメッキにより形成する。

【００１２】前記磁性体層１、２として、例えばニッケル－銅－亜鉛系のフェライトを用いた場合には、低周波用（高透磁率）磁性体層１として亜鉛リッチでかつ透磁率を例えば２００～１０００に設定したものを用い、高周波用（低透磁率）磁性体層２としてニッケルリッチでかつ透磁率を例えば１０～１００に設定したものを用いる。また、中間層９としては、非磁性フェライトを用いる。

【００１３】図２（Ａ）の上段は高透磁率層１および低透磁率層２の周波数に対する透磁率の変化を示し、下段はそれぞれインダクタ５、６の周波数に対するインピーダンス変化と全体のインピーダンスの変化を示す。

【００１４】図１（Ｂ）には、この積層ノイズ対策部品における各層１、２における磁束ϕ_1、ϕ_2の流れを示しており、本実施例においては、高透磁率層１と低透磁率層２との間に非磁性体でなる中間層９を設けたため、双方の層１、２にまたがる磁束の通過は減少し、それぞれの層１、２において磁束の流れがほとんど個別に生じた状態とすることができる。この積層ノイズ対策部品における磁気回路は、図２（Ｂ）に示すように表現され、起磁力V_mに対してそれぞれ高透磁率、低透磁率の各層１、２ごとに独立した磁気抵抗R_{m1}、R_{m2}が接続されたものとなる。また、等価電気回路は、図２（Ｃ）に示すように、高透磁率層１でなるコアでなるインダクタ５と、低透磁率層２でなるインダクタ６とが直列に接続されたものとして表現できる。図２（Ｃ）から理解されるように、本実施例においては、合成インピーダンス特性は、インダクタ５、６のインピーダンスを加えたものとなる。すなわち、図２（Ａ）の下段に示すように、両インダクタ５、６を加えた特性となり、周波数f_1を超えた高周波帯域においてもノイズ除去効果が得られ、広い周波数範囲についてノイズ除去効果が得られる。

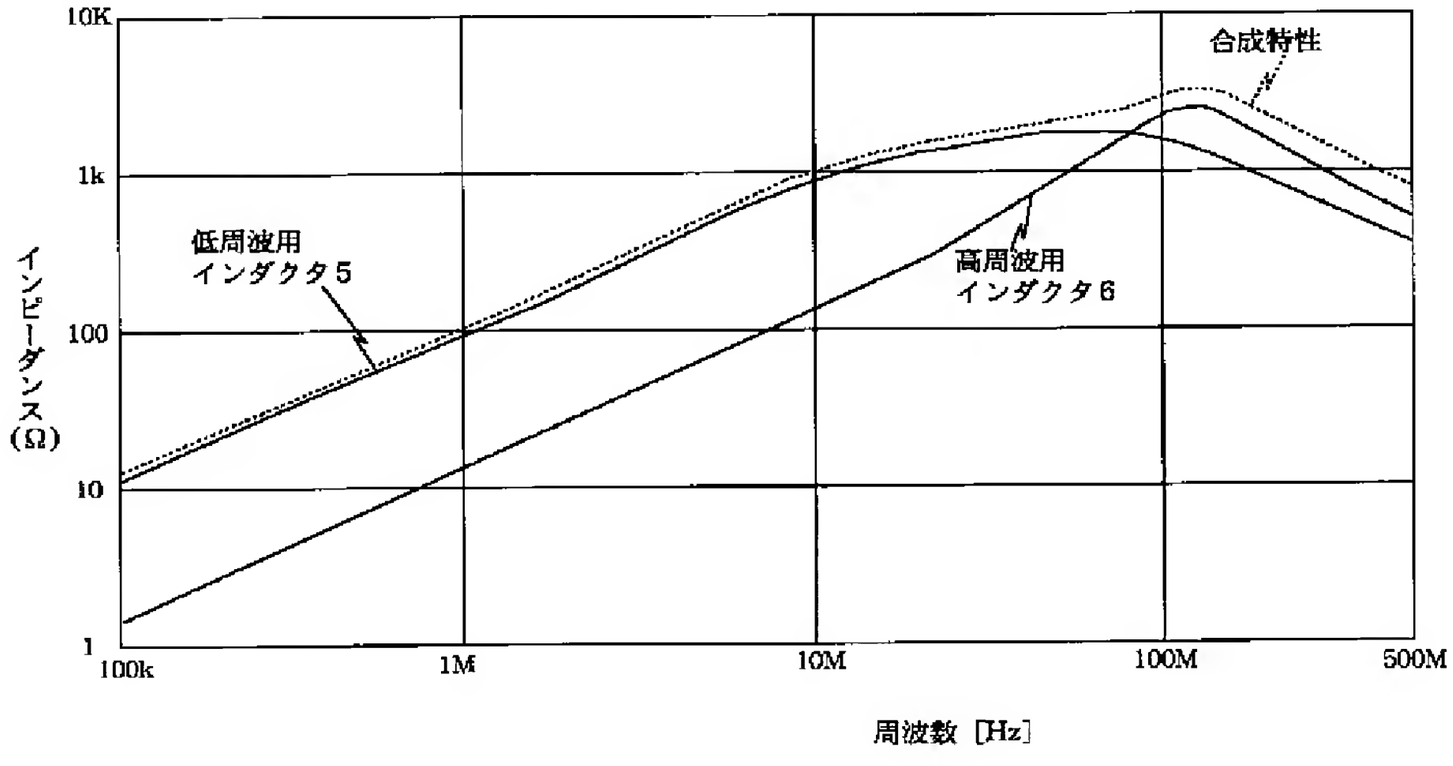
【００１５】具体例について説明すると、積層ノイズ対策部品の寸法を縦３．２ｍｍ、横１．６ｍｍ、高さ１．６ｍｍとし、高透磁率層１にFe_2O_3…４９、NiO…７、CuO…１３、ZnO…３１なる組成（原子％）のフェライトを用い、低透磁率層２にFe_2O_3…４９、NiO…２４、CuO…１０、ZnO…１７なる組成（原子％）のフェライトを用い、中間層９にFe_2O_3…４９、CuO…１２、ZnO…３９なる組成（原子％）の非磁性フェライトを用い、コイル導体３、４にAgを用い、コイルピッチＰを５０μｍ、コイル導体３のターン数を５Ts、コイル導体４のターン数を１０Tsとし、中間層９の厚みt_1を１００μｍ、中間層９とコイル導体３、４間の間隔t_2を２５０μｍとしたものにおいて、周波数に対するインピーダンスの変化を測定した結果を、それぞれインダクタ５、６を個別に構成して測定した結果と対比して図３に示す。図３から分かるように、本実施例によれば、積層ノイズ対策部品全体としてのインピーダンスは、インダクタ５、６の特性を加えたものとなる。また、従来例の構成すなわち中間層９のないものにおいて、１０ｄＢ程度の減衰が得られる周波数範囲は１５～２００MHzであったが、本発明による中間層９を設けたものにおいては、１０～４００MHzとなった。

【００１６】図４（Ａ）は本発明の他の実施例を示す縦断面図、（Ｂ）はそのＦ－Ｆ断面図であり、本実施例は、前記中間層９に、磁束の変化により短絡電流を流して磁束の通過を減少させるショートリング１１を埋設したものである。本実施例においては、中間層における磁束の通過がさらに良好に防止されるため、各インダクタ５、６の特性は前記実施例よりもさらに独立したものとなり、より特性の良好なものが得られる。

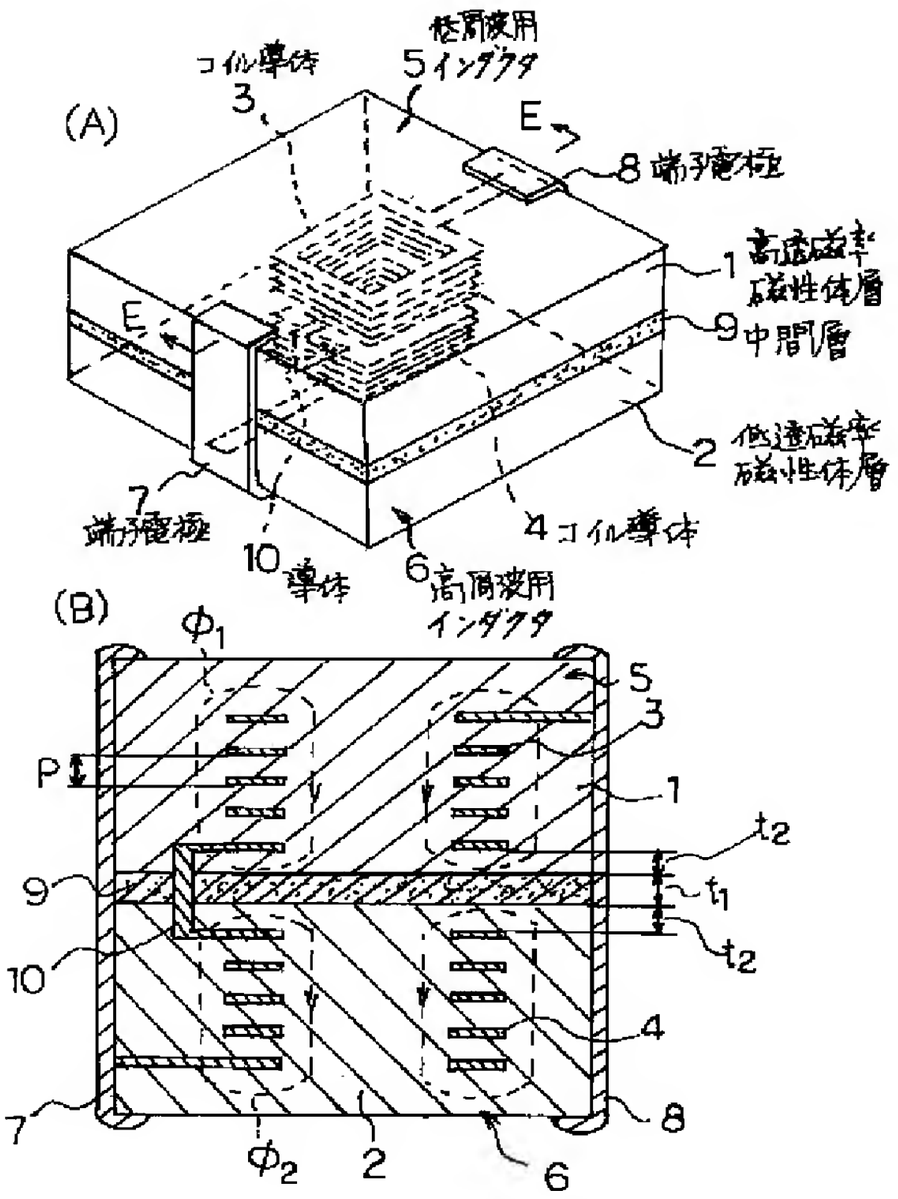
【００１７】図５（Ａ）は本発明の他の実施例であり、相対的に高い誘電率の誘電体層１２と低い誘電率の誘電体層１３とを積層し、各誘電体層１２、１３にそれぞれ対向する内部電極１４ａ、１４ｂと１５ａ、１５ｂとを埋設してそれぞれ容量の異なるコンデンサ１６、１７を構成すると共に、各コンデンサ１６、１７を端子電極１８、１９により並列に接続してなり、誘電率が異なる誘電体層１２、１３の間に前記各誘電体層より低誘電率の

中間層２０を一体に介在させたものである。
【００１８】本実施例によれば、主として高い誘電率の誘電体層１２を介してのコンデンサ１６、１７間の結合が防止されるので、図５（Ｂ）に示すように、全体として各コンデンサ１６、１７の特性を加えた減衰特性が得られる。なお、図５（Ｂ）において、コンデンサ１６、１７の特性曲線が山状のピークをなす理由は、コンデンサ容量とコンデンサ内部電極パターンのインダクタンス成分の共振（直列共振）するためである。
【００１９】本発明においては、１つのチップ内に３層以上のインダクタあるいはコンデンサを積層したもの、もしくは同一層に複数個のインダクタやコンデンサを配設したもの等にも適用できる。
【００２０】
【発明の効果】請求項１によれば、透磁率が異なる磁性体層の間に前記非磁性体でなる中間層を一体に介在させたので、各層において構成されたインダクタの特性を加えた特性のものが得られ、１個の積層体だけで、高い周波数帯域に至る広い帯域にわたり、ノイズ除去効果が得られる。
【００２１】請求項２によれば、積層体内に複数個のインダクタを構成した積層ノイズ対策部品において、各磁性体層間における磁束の通過が防止され、各インダクタの個別化がより促進され、より良好なノイズ除去効果が得られる。
【００２２】請求項３によれば、誘電率が異なる誘電体層の間に前記各誘電体層より低誘電率の中間層を一体に介在させたので、各誘電体層において構成されるコンデンサ間の結合が中間層により防止され、請求項１と同様に、各層において構成されたコンデンサの特性を加えた特性のものが得られ、１個の積層体だけで、高い周波数帯域に至る広い周波数帯域にわたってノイズ除去効果が得られる。
【図面の簡単な説明】
【図１】（Ａ）は本発明による積層ノイズ対策部品の一実施例を示す斜視図、（Ｂ）は（Ａ）のＥ－Ｅ断面図である。
【図２】（Ａ）は図１の実施例の部品の周波数特性を示す図、（Ｂ）は該実施例の等価磁気回路図、（Ｃ）は該実施例の等価電気回路図である。
【図３】本発明の周波数特性の具体例を示す図である。
【図４】（Ａ）は本発明の他の実施例の構成を示す縦断面図、（Ｂ）は（Ａ）のＦ－Ｆ断面図である。
【図５】（Ａ）は本発明によ積層ノイズ対策部品の他の実施例を示す断面図、（Ｂ）はその周波数特性図である。
【図６】（Ａ）は従来の積層ノイズ対策部品の一例を示す斜視図、（Ｂ）は（Ａ）のＧ－Ｇ断面図である。
【図７】（Ａ）は従来の積層ノイズ対策部品の周波数特性を示す図、（Ｂ）は該従来部品の等価磁気回路図、（Ｃ）、（Ｄ）はそれぞれ該従来部品における低周波帯域、高周波帯域における等価電気回路図である。
【符号の説明】
１：高透磁率磁性体層、２：低透磁率磁性体層、３、４：コイル導体、５：低周波用インダクタ、６：高周波用インダクタ、７、８：端子電極、９：中間層、１０：接続用導体、１１：ショートリング、１２：高誘電率誘電体層、１３：低誘電率誘電体層、１４ａ、１４ｂ、１５ａ、１５ｂ：内部電極、１６、１７：コンデンサ、１８、１９：端子電極、２０：中間層

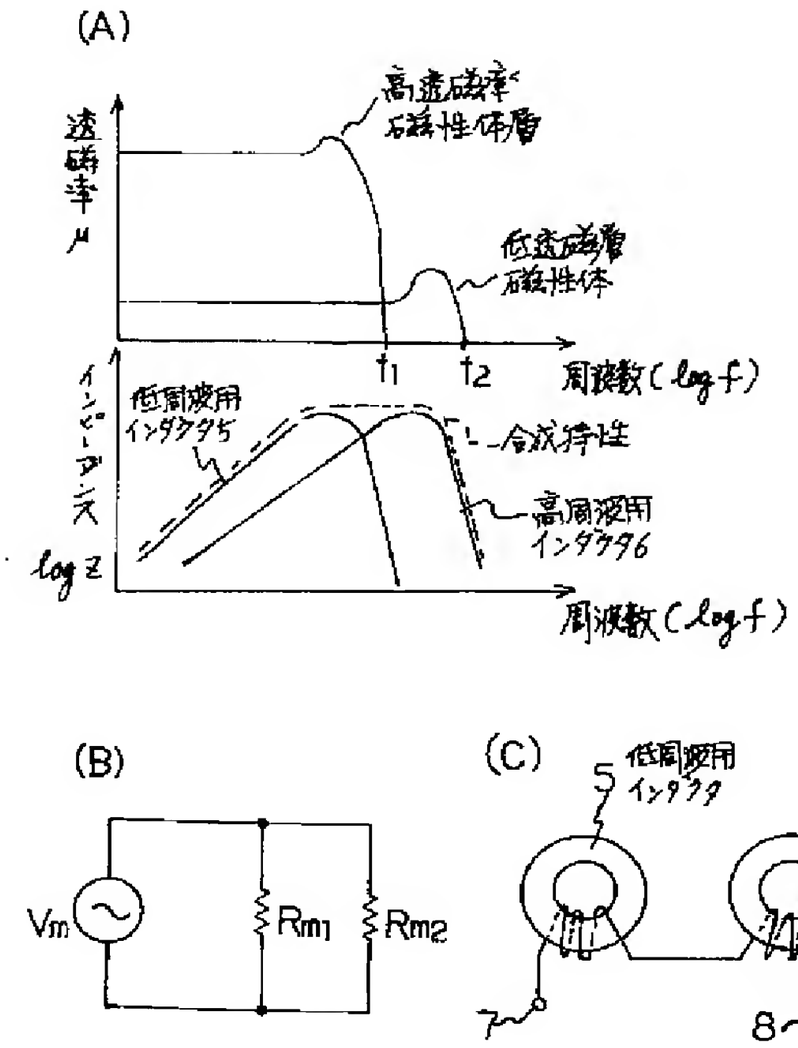
【図３】



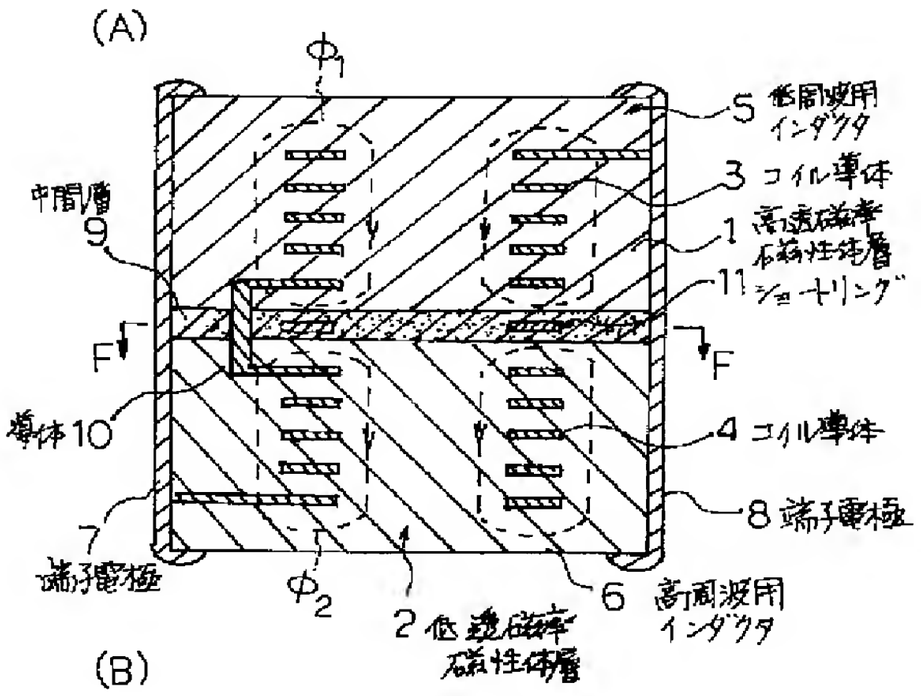
【図１】


(A)
コイル導体
3
低周波用
5インダクタ
E
8端子電極
1高透磁率
磁性体層
9中間層
2低透磁率
磁性体層
7
端子電極
10導体
6高周波用
インダクタ
4コイル導体
(B)
Φ1
5
3
P
1
t2
9
t1
t2
10
4
7
8
Φ2
2
6

【図２】


(A)
透磁率μ
高透磁率
磁性体層
低透磁率
磁性体
t1
t2
周波数(logf)
インピーダンス
低周波用
インダクタ5
合成特性
高周波用
インダクタ6
log Z
周波数(logf)
(B)
Vm
Rm1
Rm2
(C)
5低周波用
インダクタ
6高周波用
インダクタ
7
8

【図４】


(A)
Φ1
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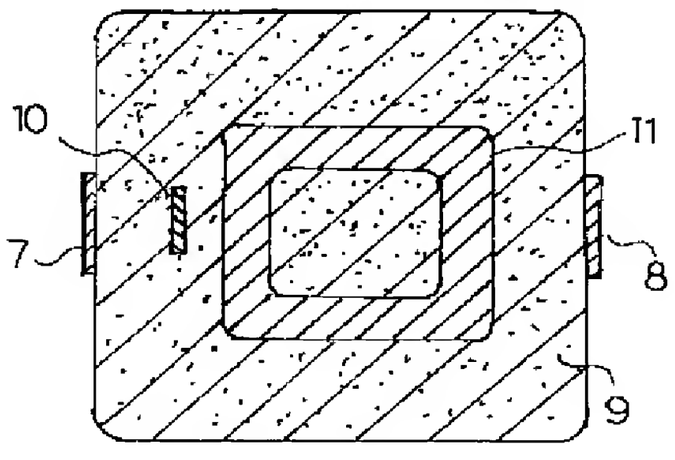
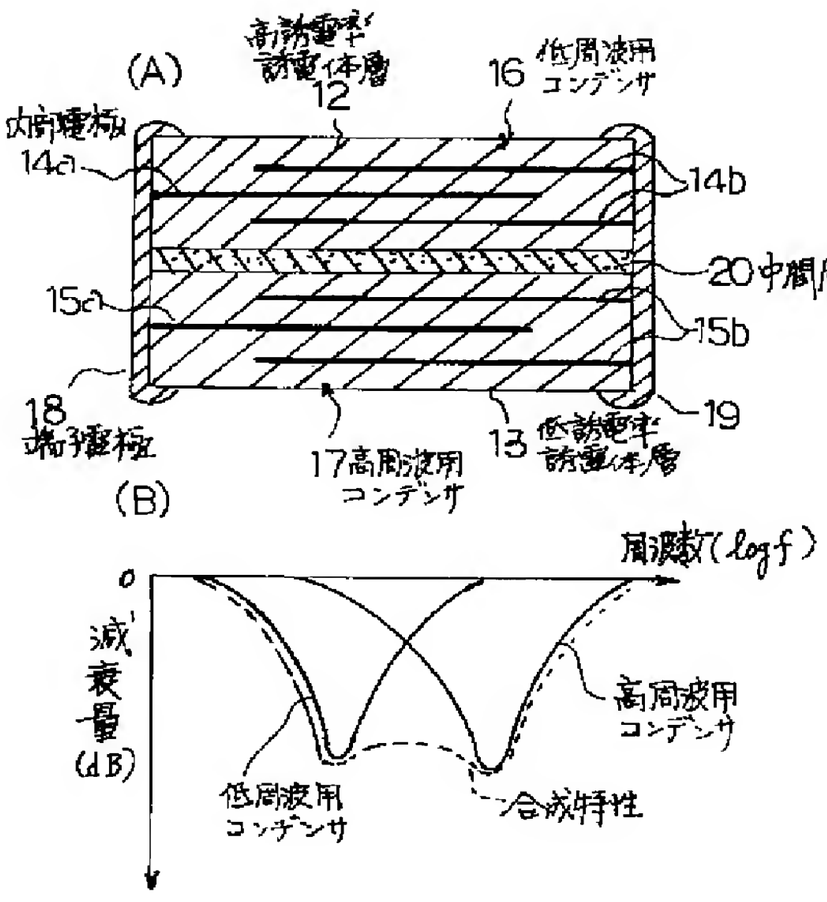
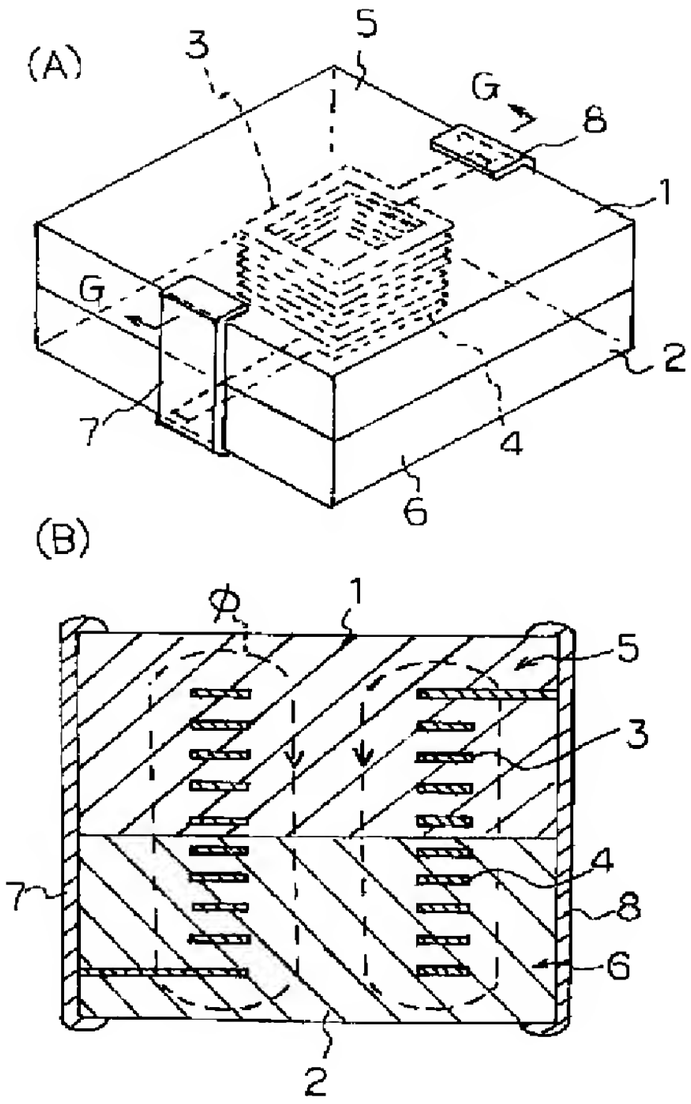
インダクタ
中間層
9
3コイル導体
1高透磁率
磁性体層
11ショートリング
F
F
導体10
4コイル導体
8端子電極
7
端子電極
Φ2
2低透磁率
磁性体層
6高周波用
インダクタ
(B)


10
11
7
8
9

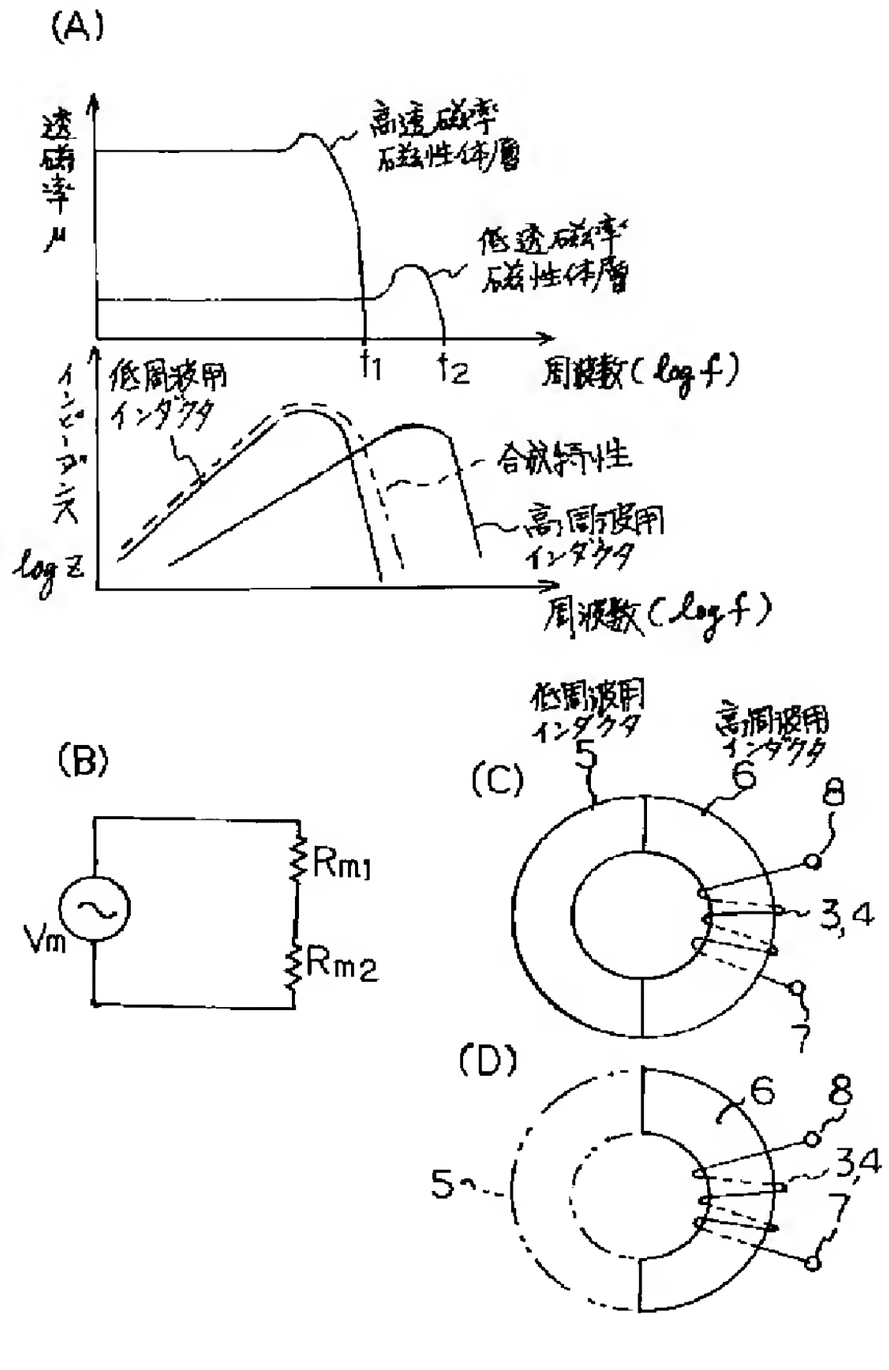
【図５】


(A)
高誘電率
誘電体層
12
16低周波用
コンデンサ
内部電極
14a
14b
20中間層
15a
15b
18
端子電極
17高周波用
コンデンサ
13低誘電率
誘電体層
19
(B)
周波数(logf)
0
減衰量
(dB)
高周波用
コンデンサ
低周波用
コンデンサ
合成特性

【図６】


(A)
3
5
G
8
1
G
2
7
4
6
(B)
1
5
3
4
7
8
6
2

【図７】


(A)
透磁率 μ
高透磁率磁性体層
低透磁率磁性体層
f1
f2
周波数(log f)
インピーダンス log Z
低周波用インダクタ
合成特性
高周波用インダクタ
周波数(log f)
(B)
Rm1
Vm
Rm2
(C)
低周波用インダクタ
高周波用インダクタ
5
6
8
3,4
7
(D)
6
8
5
3,4
7

PATENT ABSTRACTS OF JAPAN

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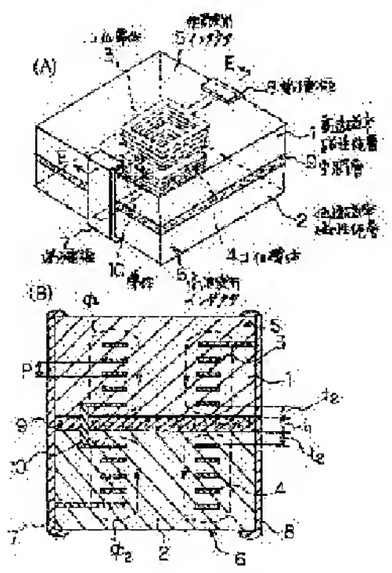
(72)Inventor : YASUDA KATSUHARU

TAKATANI MINORU

(54) LAMINATED NOISE COUNTERMEASURE COMPONENT



(57)Abstract:

PURPOSE: To make it possible to apply fully the characteristics of high-frequency and low-frequency constituent elements (inductors or capacitors) to practical use by a method wherein an intermediate layer consisting of a non-magnetic material is made to interpose between magnetic material layers, which respectively have magnetic permeabilities different from each other, integrally with the magnetic material layers.

CONSTITUTION: Coil conductors 3 and 4 are respectively built in magnetic material layers 1 and 2, which are a high-magnetic permeability magnetic material layer and a low-magnetic permeability magnetic material layer relatively to each other, and low-frequency and high-frequency inductors 5 and 6 are respectively constituted in the layers 1 and 2. Here, an intermediate layer 9 is provided between the layers 1 and 2 integrally with the layers 1 and 2. This layer 9 is constituted of a non-magnetic material. Moreover, a short-ring, which makes a short-circuit current flow by a change in a magnetic flux and reduces the passage of the magnetic flux, is buried in the layer 9. Thereby, a laminated noise countermeasure component having characteristics added with the characteristics of the inductors constituted in the layers 1 and 2 can be obtained.

LEGAL STATUS

[Date of request for examination]	16.05.2002
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3549286
[Date of registration]	30.04.2004
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

CLAIMS

[Claim(s)]

[Claim 1] two or more magnetic layers from which permeability differs -- a laminating -- carrying out -- each magnetic layer -- respectively -- a coil -- the coil built in each magnetic layer while building in the conductor -- the laminating noise cure components characterized by making the interlayer who comes with non-magnetic material between the magnetic layers from which permeability differs in the laminating noise cure components which come to connect a conductor with a serial intervene between one.

[Claim 2] The laminating noise cure components characterized by laying underground the short ring which passes a short-circuit current by change of magnetic flux to said interlayer in claim 1.

[Claim 3] The laminating noise cure components which carry out the laminating of two or more dielectric layers from which a dielectric constant differs, and are characterized by making the interlayer of a low dielectric constant intervene from said each dielectric layer at one between the dielectric layers from which a dielectric constant differs in the laminating noise cure components which come to connect each capacitor with juxtaposition while constituting the capacitor by which the internal electrode which counters each dielectric, respectively is laid underground, and capacity differs, respectively.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] two or more magnetic layers which have the permeability from which this invention differs -- respectively -- a coil -- a conductor -- building -- these coils -- the laminating of the layered product which connected the conductor to the serial, or two or more dielectric layers from which a dielectric constant differs carries out, and while constituting the capacitor by which the internal electrode which counters each dielectric, respectively is laid underground, and capacity differs, respectively, it is related with the laminating noise cure components constituted by the layered product which comes to connect each capacitor with juxtaposition.

[0002]

[Description of the Prior Art] the thick-film forming methods, such as print processes and the sheet method, -- using -- the magnetic substance and a coil -- in the laminating noise cure components constituted by the layered product of the shape of a chip which comes to carry out the laminating of the conductor, in order to acquire the noise reduction effectiveness about a large frequency band

In JP,3-30282,B, as shown in (B) which is the perspective view and its G-G sectional view of drawing 6 (A) the magnetic layers 1 and 2 which serve as high permeability (for low frequency), and low permeability (for RFs) relatively -- a laminating -- carrying out -- each magnetic layers 1 and 2 -- respectively -- a coil, while building in conductors 3 and 4 and constituting inductors 5 and 6 the coil built in each magnetic layers 1 and 2 -- the thing which comes to connect conductors 3 and 4 with a serial in the interior of a layered product is proposed. the coil connected to these single strings -- the both ends of conductors 3 and 4 are connected to the terminal electrodes 7 and 8 prepared in the side face of the layered product formed in the shape of a chip.

[0003] In the laminating noise cure components shown in drawing 6 , the frequencies f1 and f2 set to permeability =1, respectively differ, and the inductor 6 by the side of the low permeability layer 2 is expected to achieve the duty of the noise rejection in a high frequency band that the high permeability layer 1 and the low permeability layer 2 are shown in the upper case of drawing 7 (A).

[0004]

[Problem(s) to be Solved by the Invention] However, as shown in the sectional view of drawing 6 (B), it sets on the conventional laminating noise cure components. Magnetic flux phi will carry out sequential passage over the both sides of the high permeability layer 1 and the low permeability layer 2. It is grasped as a circuit where the magnetic reluctance Rm1 of the high permeability layer 1 and the magnetic reluctance Rm2 of low permeability were connected to the serial to magnetomotive force Vm. In a frequency lower than the frequency f1 from which the permeability of the high permeability layer 1 is furthermore set to 1 As shown in drawing 7 (C) as a laminating noise cure entire component, the core which consists of a high permeability layer 1 and a low permeability layer 2 is combined. It can recognize as that around which conductors 3 and 4 were wound, and a thing which makes an equivalent operation. this -- a coil -- Permeability of the high permeability layer 1 = it is higher than the frequency f1 used as 1, and in a frequency band lower than the frequency f2 from which the

permeability of the low permeability layer 2 is set to 1, as shown in drawing 7 (D), it can recognize as a magnetic circuit where the high permeability layer 1 was missing. For this reason, as shown in the lower berth of drawing 7 (A), the impedance as a laminating noise cure entire component was not able to become extent a little higher than the impedance by the inductor 5 by the high permeability layer 1, and was not fully able to employ the property of the low permeability layer 2 for RFs efficiently.

[0005] on the other hand , the laminating of the two dielectric layers of a different dielectric constant be carried out to one , the internal electrode be prepared in each dielectric layer , respectively , the capacitor for high frequency and low frequency be constituted , and in the laminating noise cure components of capacitor use which connected each capacitor to juxtaposition with the terminal electrode of a side face , in a high frequency band , in order for capacitors to join together through a high dielectric constant layer , there be a trouble that the property of the capacitor for high frequency could not fully be employed efficiently also in this case .

[0006] two or more magnetic layers which have different permeability in view of the trouble which described this invention above -- respectively -- a coil -- it aims at offering what can fully employ the property of the object for high frequency, and the component for low frequency (an inductor or capacitor) efficiently, respectively in the laminating noise cure components which contained and carried out the series connection of the conductor, or the laminating noise cure components which contained and carried out the parallel connection of the internal electrode to two or more dielectric layers which have a different dielectric constant, respectively.

[0007]

[Means for Solving the Problem] In order to attain this purpose, the laminating noise cure components of this invention are characterized by making the interlayer who consists of non-magnetic material intervene at one between the magnetic layers from which permeability differs. Moreover, it is characterized by

laying underground the short ring which a short-circuit current is passed [ring] by change of magnetic flux to said interlayer, and decreases passage of magnetic flux.

[0008] Moreover, in what constitutes a capacitor by the dielectric layer which is two or more layers from which a dielectric constant differs, it is characterized by making the interlayer of a low dielectric constant intervene from said each dielectric layer at one between the dielectric layers from which a dielectric constant differs.

[0009]

[Function] In this invention, in the thing which made the interlayer who consists of non-magnetic material between the magnetic layers from which permeability differs intervene between one, it becomes independent, respectively, the property which applied each property as a whole is acquired, and the noise rejection in the large frequency band which reaches a frequency band higher than before of the frequency characteristics of the inductor in each magnetic layer becomes possible. In what prepared the interlayer the short ring, passage of the magnetic flux in an interlayer is prevented still better. In what constitutes a capacitor by the dielectric layer which is two or more layers from which a dielectric constant differs, by having made the interlayer of a low dielectric constant intervene from said each dielectric layer at one between the dielectric layers from which a dielectric constant differs, association between different dielectric constant layers is prevented, and the synthetic property which applied the property of each capacitor is acquired.

[0010]

[Example] The perspective view showing one example of the laminating noise cure components according [drawing 1 (A)] to this invention and (B) are the E-E sectional views of (A). the coil with which 1 and 2 are high permeability and the magnetic layer of low permeability relatively, respectively, and 3 and 4 were built in each magnetic layers 1 and 2 -- it is a conductor and these constitute the inductor 5 for low frequency, and the inductor 6 for RFs, respectively. 9 is a

magnetic layer 1 and the interlayer who prepared among two at one, and this interlayer 9 consists of non-magnetic material. 10 -- each coil -- it is the conductor which connects conductors 3 and 4 in the interior of a layered product. the coil by which 7 and 8 were connected to a single string -- as it connects with the both ends of conductors 3 and 4, it is the terminal electrode prepared in the side face of a layered product.

[0011] The layered product which consists of this inductor 5 or the middle class 9 is manufactured by cutting and calcinating for every chip or cutting after baking after the laminating by print processes or the sheet method, and a desiccation process, and forms the terminal electrodes 7 and 8 in the side face of the layered product by baking or plating after that.

[0012] the case where the ferrite of for example, a nickel-copper-zinc system is used as said magnetic layers 1 and 2 -- as the magnetic layer 1 for low frequency (high permeability) -- zinc -- what was rich and set permeability as 200-1000 -- using -- as the magnetic layer 2 for high frequency (low permeability) -- nickel -- it is rich and what set permeability as 10-100 is used. Moreover, a nonmagnetic ferrite is used as an interlayer 9.

[0013] The upper case of drawing 2 (A) shows change of the permeability to the frequency of the high permeability layer 1 and the low permeability layer 2, and the lower berth shows the impedance change to the frequency of inductors 5 and 6, and change of the whole impedance, respectively.

[0014] The flow of the magnetic flux phi1 and phi2 in each class 1 and 2 in this laminating noise cure component is shown in drawing 1 (B), and it sets to this example. Since the interlayer 9 who becomes with non-magnetic material was formed between the high permeability layer 1 and the low permeability layer 2, passage of the magnetic flux over both layers 1 and 2 can decrease, and can be made into the condition that the flow of magnetic flux almost arose according to the individual in each layer 1 and 2. The magnetic circuit in this laminating noise cure component was expressed as shown in drawing 2 (B), and high permeability, each class 1 of low permeability, and the magnetic reluctance Rm1 and Rm2 that

became independent for every two were connected to magnetomotive force Vm, respectively. Moreover, as shown in drawing 2 (C), the inductor 5 which becomes with the core which becomes in the high permeability layer 1, and the inductor 6 which becomes in the low permeability layer 2 can express an equivalence electrical circuit as what was connected to the serial. In this example, a synthetic impedance characteristic becomes what applied the impedance of inductors 5 and 6 so that I may be understood from drawing 2 (C). That is, as shown in the lower berth of drawing 2 (A), it becomes the property which added both the inductors 5 and 6, the noise rejection effectiveness is acquired also in the high frequency band beyond a frequency f1, and the noise rejection effectiveness is acquired about a large frequency range.

[0015] When an example is explained, the dimension of laminating noise cure components 3.2mm long It considers as the side of 1.6mm, and height of 1.6mm, and is Fe 2O3 to the high permeability layer 1. -- 49 NiO -- 7 CuO -- The ferrite of 13 and the presentation (atomic %) which becomes ZnO--31 is used. It is Fe 2O3 to the low permeability layer 2. -- 49 NiO -- 24 CuO -- The ferrite of 10 and the presentation (atomic %) which becomes ZnO--17 is used. It is Fe 2O3 to an interlayer 9. -- 49 CuO -- 12 and the nonmagnetic ferrite of the presentation (atomic %) which becomes ZnO--39 are used. a coil -- conductors 3 and 4 -- Ag -- using -- a coil pitch P -- 50 micrometers and a coil -- the number of turns of a conductor 3 5 Tses In a conductor 3 and the thing which set spacing t2 between four to 250 micrometers a coil -- the number of turns of a conductor 4 -- 10Ts(es) -- carrying out -- an interlayer's 9 thickness t1 -- 100 micrometers, an interlayer 9, and a coil -- The result of having measured change of the impedance to a frequency is shown in drawing 3 as contrasted with the result which constituted inductors 5 and 6 according to the individual, and was measured, respectively. According to this example, the impedance as a laminating noise cure entire component becomes what applied the property of inductors 5 and 6 so that drawing 3 may show. Moreover, in the thing without the configuration 9, i.e., the interlayer, of the conventional example, although the frequency range where

attenuation of about 10dB is obtained was 15-200MHz, it was set to 10-400MHz in what formed the interlayer 9 by this invention.

[0016] Drawing of longitudinal section in which drawing 4 (A) shows other examples of this invention, and (B) are the F-F sectional view, and the short ring 11 with which this example passes a short-circuit current by change of magnetic flux to said interlayer 9, and decreases passage of magnetic flux is laid underground. In this example, since passage of the magnetic flux in an interlayer is prevented still better, the property of each inductors 5 and 6 becomes what became independent further from said example, and what has a more good property is obtained.

[0017] Drawing 5 (A) is other examples of this invention, and carries out the laminating of the dielectric layer 12 of a high dielectric constant, and the dielectric layer 13 of a low dielectric constant relatively. While constituting the capacitors 16 and 17 by which the internal electrodes 14a and 14b which counter each dielectric layers 12 and 13, respectively, and 15a and 15b are laid underground, and capacity differs, respectively The interlayer 20 of a low dielectric constant is made to intervene from said each dielectric layer at one among the dielectric layers 12 and 13 from which it comes to connect each capacitors 16 and 17 with juxtaposition with the terminal electrodes 18 and 19, and a dielectric constant differs.

[0018] Since association between the capacitor 16 which mainly minds the dielectric layer 12 of a high dielectric constant, and 17 is prevented according to this example, as shown in drawing 5 (B), the damping property which applied the property of each capacitors 16 and 17 as a whole is acquired. In addition, in drawing 5 (B), the reason the characteristic curve of capacitors 16 and 17 makes a crest-like peak is for the inductance component of capacitor capacity and a capacitor internal electrode pattern resonating (series resonance).

[0019] In this invention, it is applicable to the thing which carried out the laminating of the inductor or capacitor of three or more layers into one chip, or the thing which arranged two or more inductors and capacitors in the same layer.

[0020]

[Effect of the Invention] Since the interlayer who comes with said non-magnetic material between the magnetic layers from which permeability differs was made to intervene between one according to claim 1, the thing of a property which applied the property of the inductor constituted in each class is obtained, the wide band which reaches a high frequency band only in one layered product is covered, and the noise rejection effectiveness is acquired.

[0021] According to claim 2, it sets on the laminating noise cure components which constituted two or more inductors in the layered product, passage of the magnetic flux between each magnetic layer is prevented, individualization of each inductor is promoted more, and the better noise rejection effectiveness is acquired.

[0022] Since the interlayer of a low dielectric constant was made to intervene from said each dielectric layer at one between the dielectric layers from which a dielectric constant differs according to claim 3 Association between the capacitors constituted in each dielectric layer is prevented by the middle class, and the thing of a property which applied the property of the capacitor constituted in each class like claim 1 is obtained. Only by one layered product The noise rejection effectiveness is acquired over the large frequency band which reaches a high frequency band.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The perspective view showing one example of the laminating noise cure components according [(A)] to this invention and (B) are the E-E sectional views of (A).

[Drawing 2] The equivalence magnetic-circuit Fig. of this example and (C of drawing in which (A) shows the frequency characteristics of the components of the example of drawing 1 , and (B)) are the equivalence electrical diagrams of this example.

[Drawing 3] It is drawing showing the example of the frequency characteristics of this invention.

[Drawing 4] Drawing of longitudinal section in which (A) shows the configuration of other examples of this invention, and (B) are the F-F sectional views of (A).

[Drawing 5] The sectional view where (A) shows other examples of ****** noise cure components to this invention, and (B) are the frequency-characteristics Fig.

[Drawing 6] The perspective view in which (A) shows an example of the conventional laminating noise cure components, and (B) are the G-G sectional views of (A).

[Drawing 7] Drawing in which (A) shows the frequency characteristics of the conventional laminating noise cure components, and (B) are the equivalence electrical diagrams in a low frequency band [in / conventionally / this / in respectively the equivalence magnetic-circuit Fig. of components, (C), and (D) / components], and a high frequency band conventionally [this].

[Description of Notations]

1: a high permeability magnetic layer, a 2:low permeability magnetic layer, 3, and 4:coil -- a conductor and 5: -- the inductor for low frequency, the inductor for 6:RFs, 7, 8:terminal electrode, 9:interlayer, and the object for 10:connection -- a conductor, a 11:short ring, 12:quantity dielectric constant dielectric layer, and 13:

-- a low dielectric constant dielectric layer, 14a, 14b and 15a, a 15b:internal electrode, 16, 17:capacitor, 18, 19:terminal electrode, and 20:interlayer

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[Translation done.]

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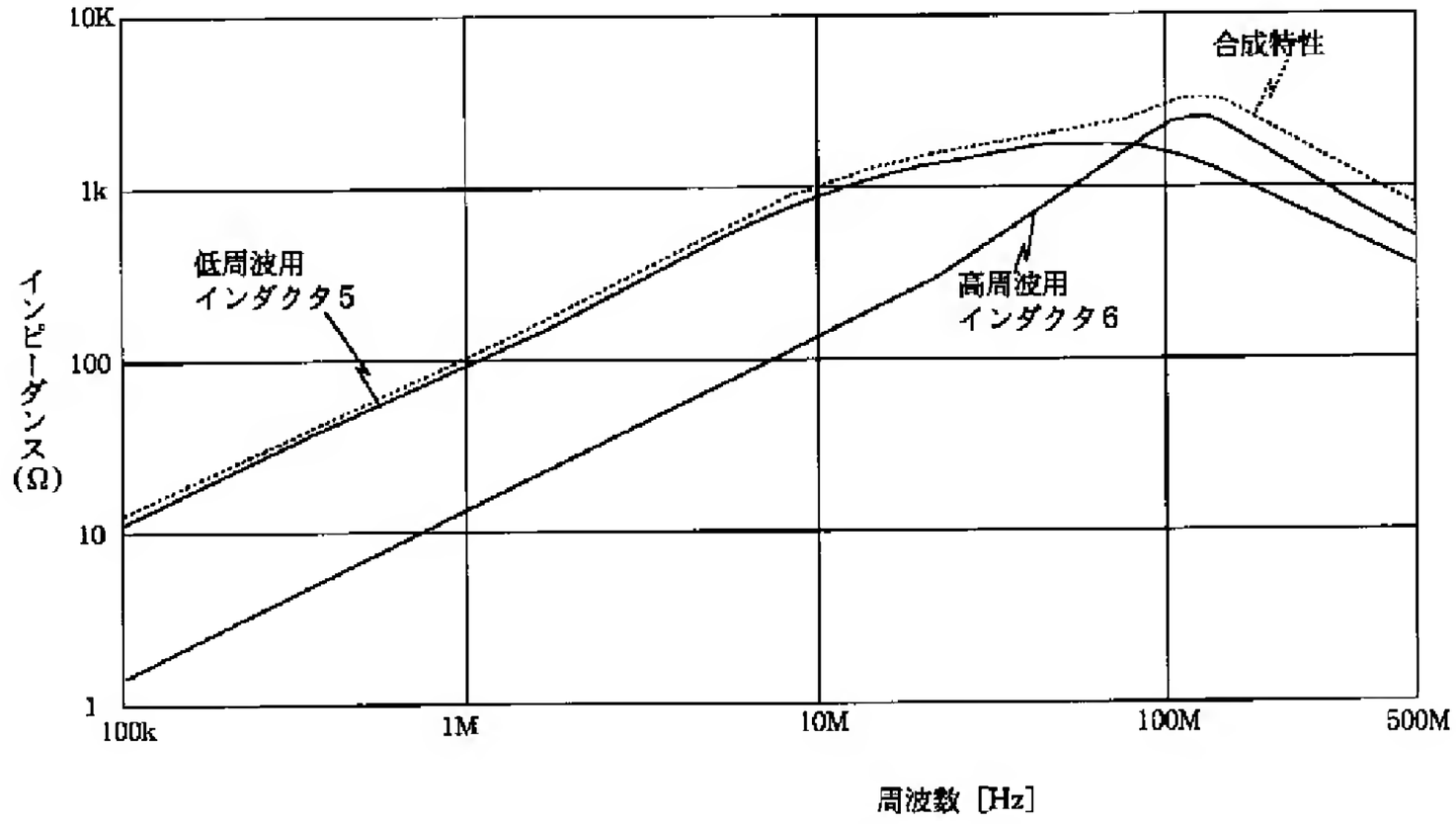
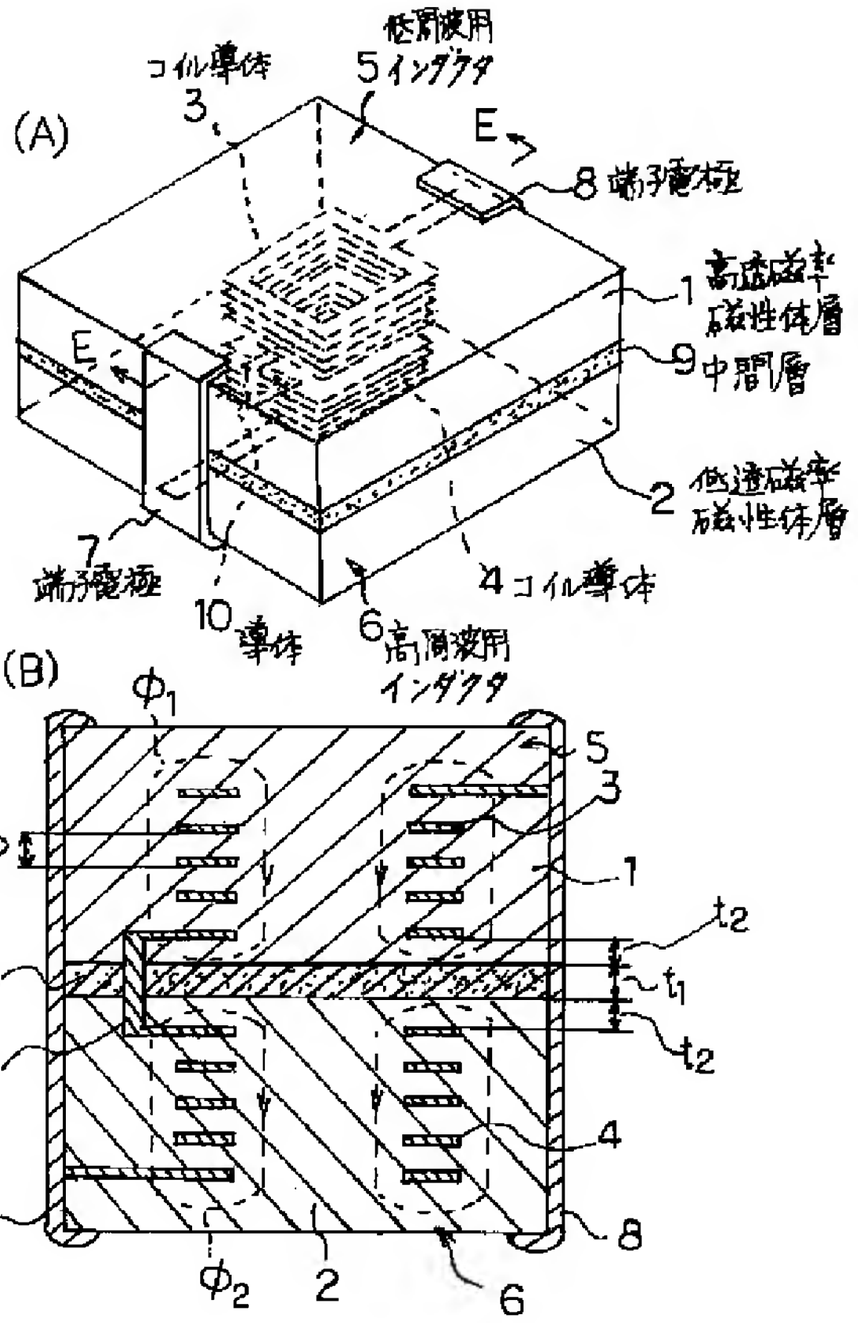
DRAWINGS

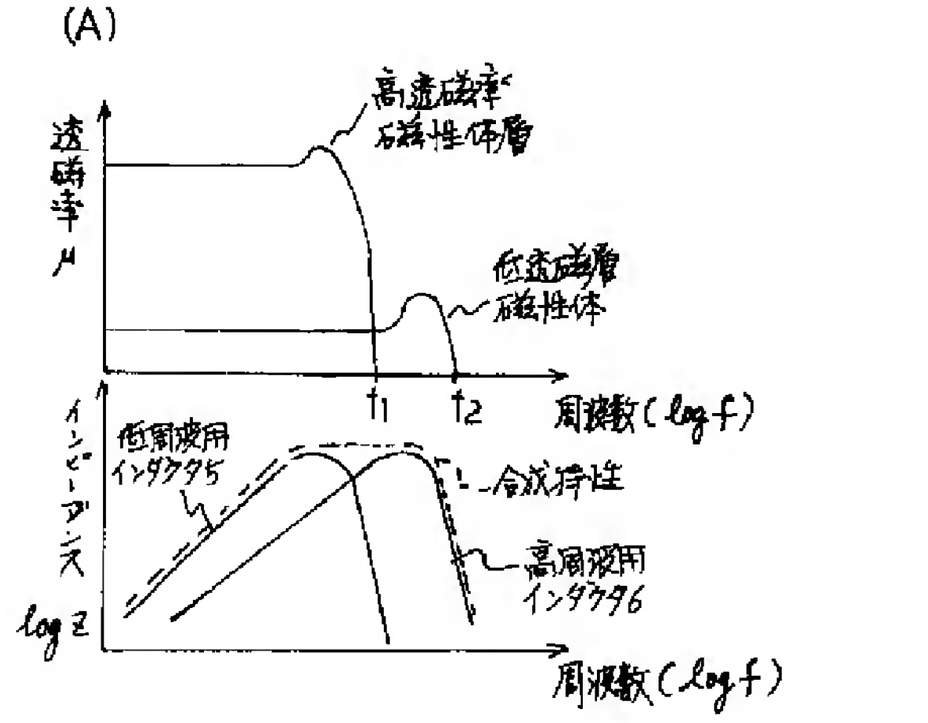
[Drawing 3]

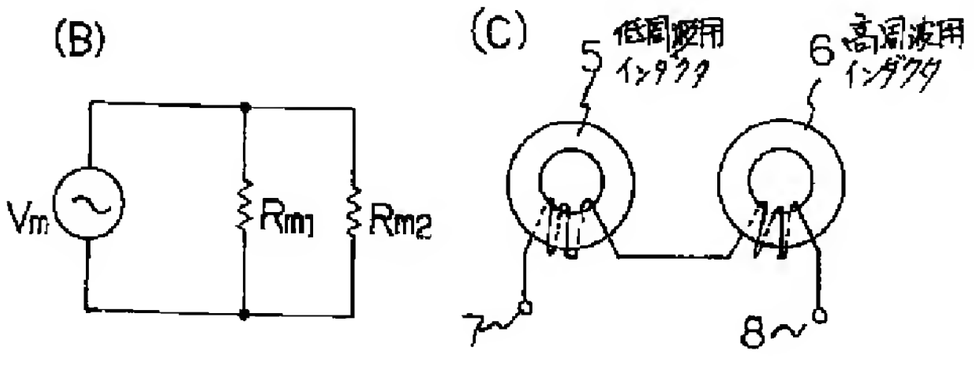


[Drawing 1]

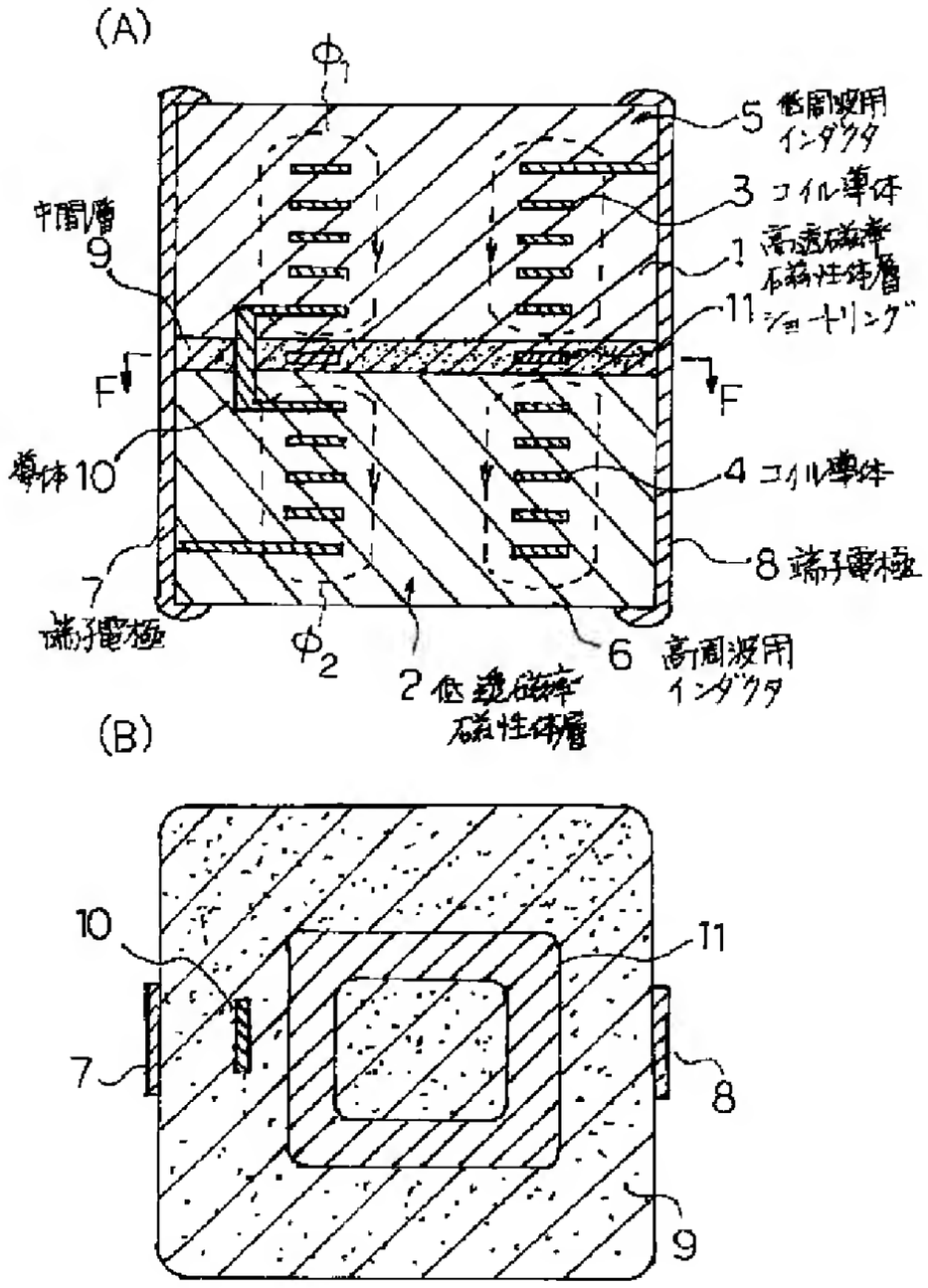

(A)
コイル導体
3
低周波用
5インダクタ
E
8端子電極
1高透磁率
磁性体層
9中間層
2低透磁率
磁性体層
E
7
端子電極
10導体
6高周波用
インダクタ
4コイル導体
(B)
ϕ_1
5
3
P
1
t_2
t_1
t_2
9
10
4
7
8
ϕ_2
2
6

[Drawing 2]

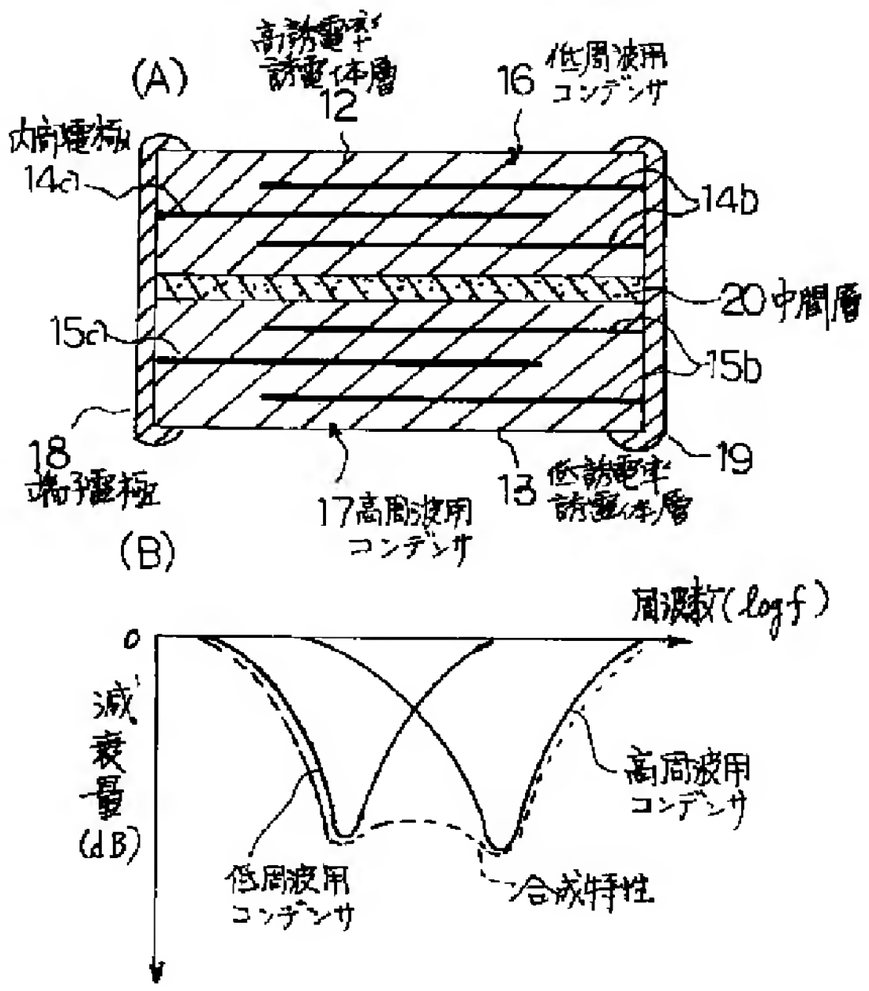

(A)
透磁率
μ
高透磁率
磁性体層
低透磁率
磁性体
f_1
f_2
周波数(log f)
インピーダンス
log Z
低周波用
インダクタ5
合成特性
高周波用
インダクタ6
周波数(log f)


(B)
Vm
Rm1
Rm2
(C)
5低周波用
インダクタ
6高周波用
インダクタ
7
8

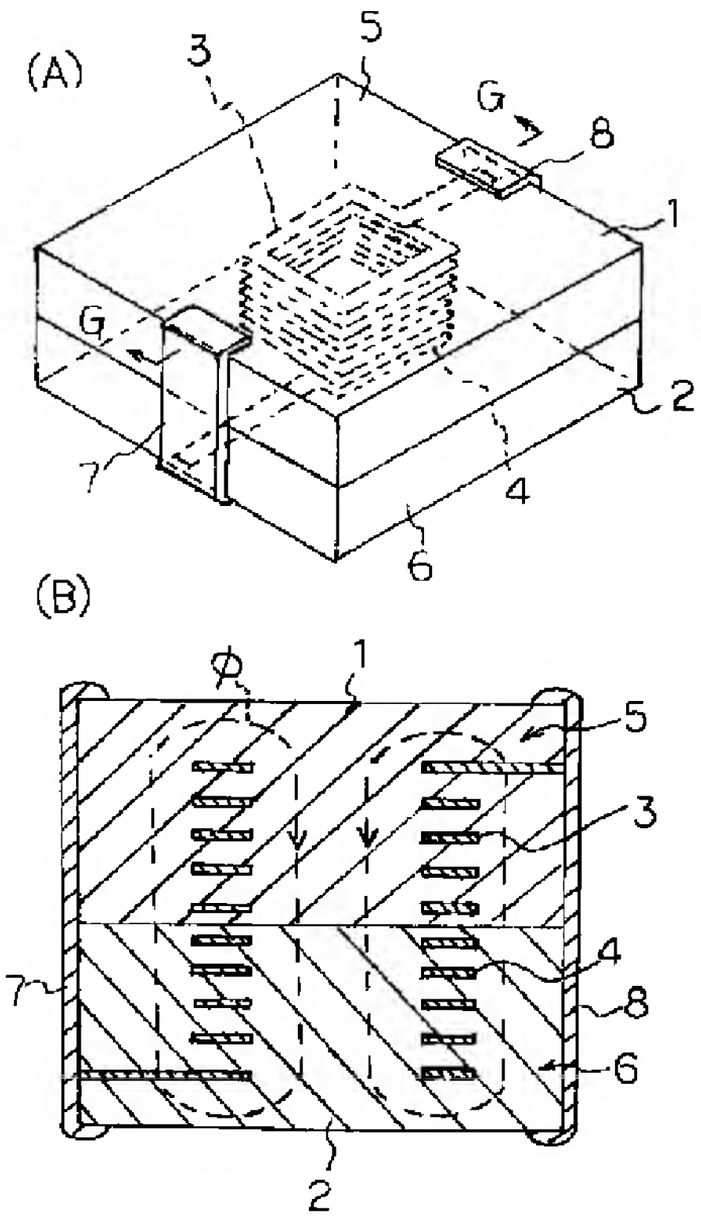
[Drawing 4]



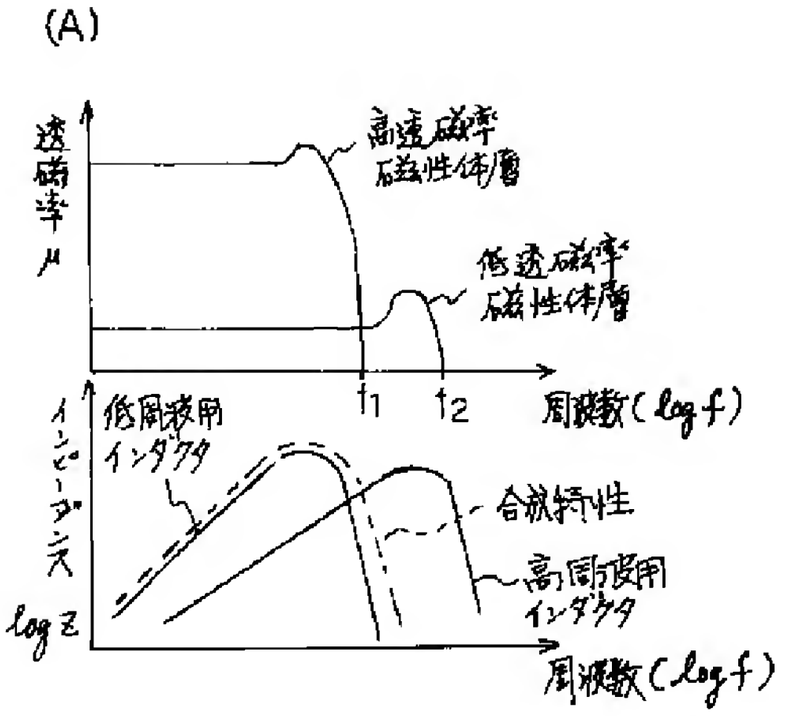
[Drawing 5]

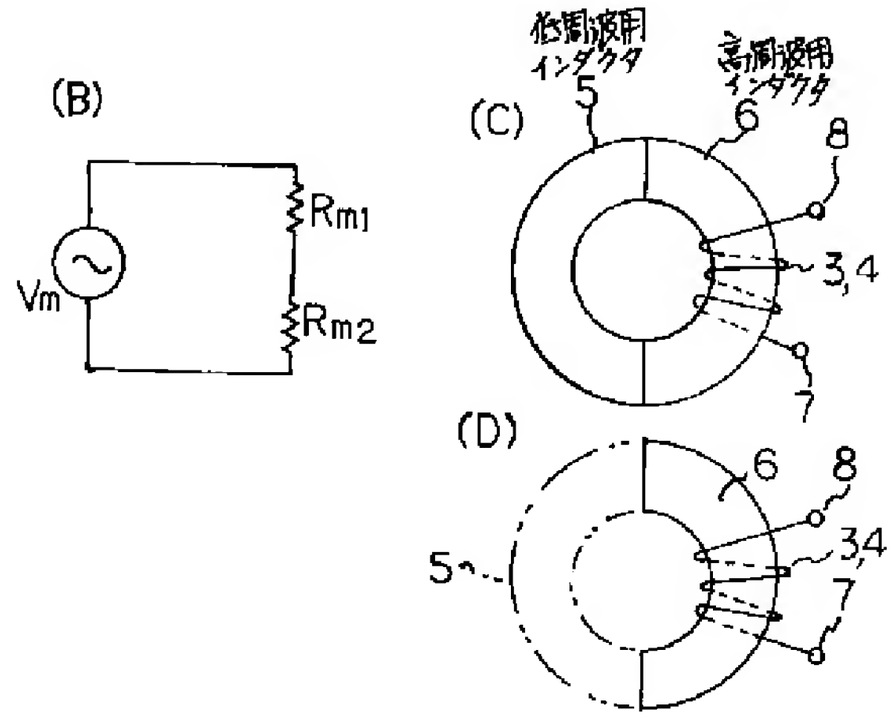


[Drawing 6]



[Drawing 7]





[Translation done.]